

A PRELIMINARY STUDY OF THE NITIDULIDAE (COLEOPTERA) IN SHAWNEE STATE FOREST, OHIO

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ABSTRACT: Various collecting techniques were utilized to discover nitidulid diversity in a forest in Scioto Co., Ohio, near the Ohio River. During two collecting periods, 20 species were identified. Four specimens of *Colopterus*, however, were not determined beyond genus, thus a minimum of 21 species were collected. Six of these species were previously recorded from Scioto County, and 14 of the 20 species identified are new county records based on The Ohio State University collection of identified Nitidulidae. The five most abundant species in descending order were: *Stelidota geminata*, *Stelidota octomaculata*, *Glischrochilus obtusus*, *Epuraea helvola*, and *Epuraea peltoides*. All of the *Stelidota octomaculata* and *Epuraea helvola*, and all but five of the *Stelidota geminata* were caught in ground traps during late season. All of the *Glischrochilus obtusus* and all but one of the *Epuraea peltoides* were collected in aerial traps in early season.

In an effort to further our knowledge of the richness and abundance of Nitidulidae in Ohio, a survey was conducted from June 2 to 6 (early season) and from 27 August to 10 September (late season) at Shawnee State Forest in Scioto Co., Ohio in 1991. This site was chosen due to its south-central location within the state and its unglaciated topography. The forest encompasses more than 60,000 acres with several species of oaks, hickories, and shortleaf pines constituting the bulk of the diverse overstory vegetation. Sassafras, ash, elm, walnut, maple, and many other hardwoods are also present. Both surveys (early and late season) were located approximately 16 km southwest of Portsmouth, Ohio in the southcentral part of the forest.

MATERIALS AND METHODS

Early Season (2-6 June)

In the early season we utilized traps (Figure 1) made from plastic 4 l milk jugs which were modified by cutting openings in the upper half to allow insects to enter (R. Androw, pers. comm.). Approximately 0.5 l of bait solution was placed in each jug of four traps. The bait was composed of 0.5 kg of brown sugar, 4 l of water, and a small amount of soil to pro-

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Fig. 1. Gallon jug trap used in early season trapping.

vide wild yeast. Using wires attached to tree branches, the jugs were suspended around 1.5 m above the ground. Traps were in a line spaced about 0.4 km between traps. Collections were made once from traps at the end of the trapping period. These collections were rinsed in fresh water and preserved in 70% alcohol until insect determinations were made.

Late Season (27 August - 10 September)

The late season survey trapping period was lengthened and replicated at two locations, both within 6.5 to 8.0 km of the Ohio River. The first late season trial was placed in a low ravine about 5 km from State Route 52 just off of State Forest Road 1, while the second was located about 135-150 m higher on a ridge about 5 km NNW of the first trial just off of State Forest Road 2. Each trial consisted of seven treatments replicated four times in a complete randomized block design. Spacing between traps was 9.0 m. The seven treatments used at both test sites were baits proven effective in previous trials (Williams *et al.* 1992). They are as follows: fermenting malt/molasses solution, fermenting brown sugar solution (same as early season), vinegar, cantaloupe, acorns (red oak), whole wheat bread dough, and smoked ham and bacon.

The malt/molasses solution was prepared using liquid Maltsupex® brand malt soup extract (Wallace Laboratories Division of Carter-Wallace Inc., Cranbury, NJ 08512) and livestock feed molasses obtained from a local feed company. The preparation of the malt/molasses solution was as follows: 50 ml of Maltsupex®, 50 ml of molasses, 50 ml of granulated sugar and a pinch of active dry yeast (Fleischmann's Yeast Inc., Oakland, CA 94603) per liter of warm water. One hundred-fifty ml of the above solution of malt/molasses was placed in each trap.

The brown sugar solution was prepared using light brown sugar (Scot Lad Foods Inc., Distributors, Lansing, IL 60438). In our mixture we used approximately 350 g of brown sugar and a pinch of Fleischmann's active dry yeast per liter of warm water. About 150 ml of this mixture was used in each brown sugar trap.

The vinegar traps were baited using pure, uncut, apple cider vinegar (Scot Lad Food Inc., Distributors, Lansing, IL 60438). Approximately 150 ml of vinegar was used in each trap.

The cantaloupe used was usually overripe and was cut into 5 cm squares with the rind intact. one cube was placed in each trap.

Acorns were shown to be an excellent attractant for *Stelidota octomaculata* (Say), as this species is a primary pest of many germinating oaks (Galford *et al.*, 1991). Each portion of our acorn bait was prepared by cutting 4 red oak acorns in half and then partially wrapping them in a moist paper towel to promote germination.

The whole wheat bread dough was made by mixing 0.5 kg of whole wheat flour, 15 ml of sugar, 300 ml of warm water and a 7 g package of Fleischmann's dry active yeast. A "hunk" of dough (about 50 ml) was rolled into a ball and wrapped in a piece of fiberglass screen to prevent the beetles from becoming imbedded in the dough. This screen-covered ball, held together with a twist tie, was then placed in the trap.

Ganglbauer (1899) observed that several of the carrion feeders in the genus *Nitidula* were frequently found in houses on smoked bacon. W. A. Connell (pers. comm.) also noted that the genus *Nitidula* is often collected on smoked hams in Virginia and North Carolina. To entice sap beetles associated with carrion, we used equal weights of sliced smoked bacon and sliced smoked ham. The total weight of these meats placed in each trap was about 150 g.

The late season trap, used only at ground level, was the nitidulid inventory technique (NIT) trap (Figure 2) which is a modification of the trap used by Skalbeck (1976). The NIT trap consists of a 1-liter wide mouth canning jar, with a plastic cone (a tapered drinking cup with bottom removed) inserted in the mouth of the jar and held in place by the canning ring. A 15 cm square of 6.5 mm thick Masonite board was attached about 2 cm above the mouth of the jar as a rain cover. Once the traps were set in the ground, they were covered with a 60 cm square



Fig. 2. NIT trap made of a 1-quart wide mouth canning jar with a funnel, an isolated bait container, and a rain cover. The cover is held in place with duct tape.

piece of "chicken wire", which was anchored to the ground using 25 cm landscaping spikes. This prevented pilfering by raccoons and other hungry mammals. Traps were set out on 27 August, and the contents were collected on 4 September and again on 10 September.

RESULTS

Early Season

Table 1 lists the early season species collected as well as their abundance. Species diversity for early season was much greater than expected for a collection period of only four days. Fifteen species were collected, many of which were seldom encountered in our previous collections over many years (Williams and Krueger 1985, Williams *et al.* 1992). Examples include: *Lobiopa undulata* (Say), *Colopterus maculatus* (Erichson), *Cryptarcha strigulata* Parsons, *Cychramus adustus* Erichson, and *Glischrochilus obtusus* (Say). *G. obtusus*, much to our surprise, was the most abundant species in the early season, constituting 43% of the nitidulids collected. In ten previous years, we have only encountered two specimens of this species using similar collection techniques. Here, in

just four days, we collected 137 specimens.

Of the six most abundant nitidulids collected, none are considered pests or nuisance species in Ohio or neighboring states. The only pest species in Table 1 are *Stelidota geminata*, *Glischrochilus fasciatus*, *G. quadrisignatus* and *Carpophilus lugubris*, and these composed only 3% of the total specimens collected.

Late Season

Surprisingly, only 11 species were encountered in our late season collections (Table 2). Three species, *Stelidota geminata* (Say), *S. octomaculata* (Say), and *Epuraea helvola* Erichson, comprised 95 percent of that total catch.

Of the nitidulids taken in late season, only *Pallodes pallidus* (Beauvois) is considered rare for Ohio, as we have seen very few of these beetles in our collections around the state. Three other species, *Carpophilus hemipterus* (L.), *Epuraea helvola* Erichson, and *Stelidota octomaculata* (Say), although not endangered, could be considered locally rare according to criteria used in a similar study (Williams *et al.*, 1992). All remaining species are generally quite common throughout Ohio. Also of interest is that only 298 beetles were caught at the lower site, whereas 1054 (78%) were caught at the upper site, (135-150 m higher in elevation). The most conspicuous vegetation at the lower site consisted of tulip poplar, sassafras, and several species of oak with poison ivy undergrowth, whereas the upper site was composed of mostly chestnut oak and hickory with a greenbrier (catbrier) and blueberry undergrowth. Whether or not the difference in elevation or vegetation promoted this imbalance is uncertain as, surely, many other factors are involved.

In addition to species richness and abundance (Tables 1 & 2), Table 3 lists the entire season's collections and indicates bait performance. Figure 3 illustrates bait attractiveness to the three most dominant species in the late season.

DISCUSSION

The time of year each collection was made created a species diversity difference that was not directly comparable as many species primarily emerge in mid to late summer as opposed to spring and early summer.

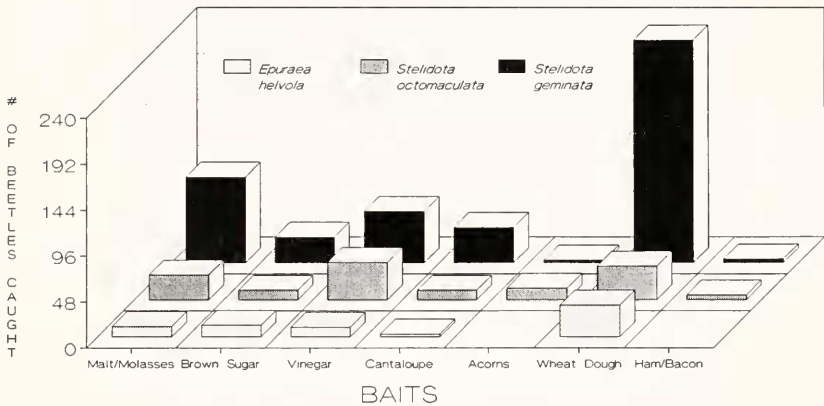


Fig. 3. Mean number of nitidulid beetles caught during late season in Shawnee State Forest, Scioto Co., Ohio 1991.

Early and Late Season

In early season collecting, gallon jug traps were suspended from tree limbs about 1.5 m above the ground. We know from previous studies (Skalbeck & Kulman 1970, Skalbeck 1976, Williams *et al.* 1992) that aerial traps are preferred by some species, whereas ground traps are preferred by others. Trap placement above the ground may account for the absence of *Stelidota octomaculata* and the scarcity of *S. geminata* captured in the early season survey (Table 1). There is some speculation that *S. octomaculata* is not a good flier. In the late season ground traps (Table 2), there was a many fold increase in the collection of *Stelidota geminata* compared to early season. It was the most abundant species in the ground traps, followed by *S. octomaculata*.

The abundance of *Epuraea helvola* in late season ground traps seemed unusual as we had previously not experienced such a large quantity while using similar traps in northeastern and north central Ohio (Williams *et al.* 1992). Approximately 10% of all nitidulids collected were *E. helvola*. In Minnesota, Skalbeck (1976) reported 16 species of *Epuraea*, of which the two most prevalent species were *E. helvola* and *E. peltoides*.

The most abundant species in the early season traps was *Glischrochilus obtusus*, which is the largest species of this genus in the state. This conspicuous, colorful species was first brought to our attention because it was so abundant in brown sugar traps set out for Cerambycidae in the southern part of the state (Scioto, Vinton, and Ross counties) that it became a nuisance. *G. obtusus* is found in northern Ohio, but is uncommon.

Peng and Williams (1991) found that *G. quadrisignatus* preferred traps about 2 m above the ground in an apple orchard. In an open area, however, more were taken on the ground. In northeastern Ohio this is the most abundant species of *Glischrochilus* followed by *G. fasciatus* (Williams *et al.* 1992). In Shawnee State Forest, we collected only three specimens, one in the aerial traps and two in the ground traps. Only one specimen of *G. fasciatus* was taken and it was in an aerial trap. Apparently in this mostly arboreal setting in Scioto County, this species is not very common. It is known that one of the preferred breeding sites for *G. quadrisignatus* is in the ears of downed corn (Foott & Timmins 1971).

An additional species of nitidulid was found in the forest along State Forest Road 1 just outside the Civilian Conservation Camp (about 6.5 km directly north of the lower site) in the flowers of Convolvulaceae. Several specimens of *Conotelus obscurus* Erichson were collected from the flowers of morning glory, *Ipomoea* sp. This long, narrow beetle resembles a rove beetle, *Stenus* sp. (Staphylinidae); however, unlike rove beetles, nitidulids have clubbed antennae and occupy different ecological niches.

In summary, at least 21 species of nitidulids were collected in the Shawnee State Forest during the 1991 growing season (Table 3). All of these species had been previously collected in the state of Ohio. Comparison of the species record from the current study with the nitidulids in The Ohio State University collection showed that there were new county records. In Table 3, all were new records for Scioto County with the exception of *Carpophilus lugubris*, *Conotelus obscurus*, *Cychramus adustus*, *Epuraea alternata*, *Epuraea helvola*, and *Pallodes silaceus* (= *pallidus*). Three species which had been taken previously in the county but were not taken in our studies are *Epuraea umbrosa* Horn, *Phenolia grossa* (Fabricius), and *Prometopia sexmaculata* (Say). With the addition of these specimens to our study, there are now 24 known species of Nitidulidae from Scioto County, Ohio.

Table 1. Early season inventory of Nitidulidae collected from gallon jug traps in the Shawnee State Forest, Scioto Co., Ohio, 2-6 June, 1991.

Species collected	Number Collected
<i>Glischrochilus obtusus</i> (Say)	137
<i>Epuraea peltoides</i> Horn	78
<i>Glischrochilus sanguinolentus</i> (Olivier)	24
<i>Lobiopa undulata</i> (Say)	21
<i>Cryptarcha ampla</i> Erichson	15
<i>Cryptarcha concinna</i> Melsheimer	15
<i>Colopterus maculatus</i> (Erichson)	8
<i>Cryptarcha strigulata</i> Parsons	5
<i>Stelidota geminata</i> (Say)	5
<i>Carpophilus lugubris</i> Murray	3
<i>Cychramus adustus</i> Erichson	2
<i>Epuraea alternata</i> Parsons	2
<i>Carpophilus corticinus</i> Erichson	1
<i>Glischrochilus fasciatus</i> (Olivier)	1
<i>Glischrochilus quadrisignatus</i> (Say)	1
Total	318

Table 2. Late season inventory of Nitidulidae collected using NIT traps at two sites in the Shawnee State Forest, Scioto, Co., Ohio, 27 August-10 September, 1991 .

Species collected	Number Collected
<i>Stelidota geminata</i> (Say)	892
<i>Stelidota octomaculata</i> (Say)	271
<i>Epuraea helvola</i> Erichson	134
<i>Epuraea alternata</i> Parsons	41
<i>Carpophilus lugubris</i> Murray	11
<i>Colopterus</i> sp.	4
<i>Carpophilus hemipterus</i> (L.)	2
<i>Epuraea peltoides</i> Horn	2
<i>Glischrochilus quadrisignatus</i> (Say)	2
<i>Carpophilus corticinus</i> Erichson	1
<i>Pallodes pallidus</i> (Beauvois)	1
Total	1361

Table 3. Total Nitidulid catches for various baits over the entire season (early and late season combined). Shawnee State Forest, Scioto County, Ohio 1991.

Species	Malt/ Molasses	Brown Sugar	Vinegar	Canta- loupe	Acorns (Red Oak)	Wheat Dough	Smoked Bacon/Ham	Total
<i>Stel. geminata</i>	180	59	106	73	5	466	8	897
<i>Stel. octomaculata</i>	51	20	77	20	24	68	11	271
<i>Glis. obtusus</i>	0	137	0	0	0	0	0	137
<i>Epur. helvola</i>	21	23	19	6	0	65	0	134
<i>Epur. peltoides</i>	0	78	0	0	0	2	0	80
<i>Epur. alternata</i>	11	3	4	2	0	19	4	43
<i>Glis. sanguinolentus</i>	0	24	0	0	0	0	0	24
<i>Lobi. undulata</i>	0	21	0	0	0	0	0	21
<i>Cryp. ampla</i>	0	15	0	0	0	0	0	15
<i>Cryp. concinna</i>	0	15	0	0	0	0	0	15
<i>Carp. lugubris</i>	3	5	0	0	0	6	0	14
<i>Colo. maculatus</i>	0	8	0	0	0	0	0	8
<i>Cono. obscurus</i> ¹	0	0	0	0	0	0	0	7
<i>Cryp. strigulata</i>	0	5	0	0	0	0	0	5
<i>Colo. sp.</i>	0	2	0	0	0	2	0	4
<i>Glis. quadrisignatus</i>	0	1	0	0	0	2	0	3
<i>Carp. hemipterus</i>	1	0	0	0	0	1	0	2
<i>Carp. corticinus</i>	0	1	0	0	0	1	0	2
<i>Cych. adustus</i>	0	2	0	0	0	0	0	2
<i>Glis. fasciatus</i>	0	1	0	0	0	0	0	1
<i>Pall. pallidus</i>	0	0	0	0	0	1	0	1
Total	267	420	206	101	29	633	23	1,686

¹*Conotelus obscurus* was taken from the flowers of *Ipomoea* sp. (Convolvulaceae).

Table 4. Bait and site comparison of the three most prominent nitidulids in late season, Shawnee State Forest, Scioto Co., Ohio, 1991.

(August 27-September 10)

Species	Malt/ Molasses		Brown Sugar		Vinegar		Canta- loupe		Acorns (Red Oak)		Wheat Dough		Smoked Bacon/Ham	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
<i>Stelidota geminata</i>	35	145	19	34	18	89	19	54	3	2	163	303	6	2
<i>Stelidota octomaculata</i>	1	50	1	19	5	72	2	18	2	22	5	64	4	6
<i>Epuraea helvola</i>	1	20	0	23	1	18	0	6	0	0	3	62	0	0
Totals:	37	215	20	76	24	179	21	78	5	24	171	429	10	8

1 = Lower site (Trial 1)

2 = Upland site (Trial 2)

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LITERATURE CITED

- Foott, W. H. and P. R. Timmins.** 1971. Importance of field corn as a reproductive site for *Glischrochilus quadrisignatus* (Say) (Coleoptera: Nitidulidae). Proc. Entomol. Soc. Ont. 01:73-75.
- Galford, J. R., R. N. Williams, and A. Daugherty.** 1991. Life history and notes on the biology of *Stelidota octomaculata* (Coleoptera: Nitidulidae). Res. Paper NE-644. Radnor, PA: U.S. Dept. of Agric., Forest Service, Northeastern Forest Experiment Station. 7 p.
- Ganglbauer, L.** 1899 Die Käfer von Mitteleuropa. 1-3. Wien.
- Peng, C. and R. N. Williams.** 1991. Effect of trap design, trap height, and habitat on the capture of sap beetles (Coleoptera: Nitidulidae) using whole wheat bread dough. J. Econ. Entomol. 84(5):1515-1519.
- Skalbeck, T. C. and H. M. Kulman.** 1970. Occurrence of nitidulid beetles in fermenting bait traps located at two vertical locations in five species of trees. Proc. North Central Branch Entomol. Soc. Amer. 25(1):54-55. (Abstract).
- Skalbeck, T. C.** 1976. The distribution of Nitidulidae in deciduous forests of Minnesota. Ph. D. Thesis, University of Minnesota, Minneapolis, MN. 204 pp. (unpublished).
- Williams, R. N., and H. R. Krueger.** 1985. Nitidulids (Coleoptera: Nitidulidae) associated with Chinese chestnuts. Entomol. News. 96(5):214-218.
- Williams, R. N., J. L. Blackmer, D. S. Richmond, and M. S. Ellis.** 1992. Nitidulidae (Coleoptera) diversity in three natural preserves of Portage County, Ohio. Ohio J.. Sci. 92(4):82-87.